

WHAT IS CLAIMED IS:

1. A wide-band dispersion controlled optical fiber, characterized in that a cut-off wavelength is substantially 1285 nm or less, dispersion values are -12 to -4 ps/nm/km in a wavelength region of substantially 1285 nm to 1330 nm and 8 to 14 ps/nm/km at substantially 1625 nm wavelength, a zero dispersion wavelength is positioned in a wavelength region below substantially 1430 nm, wherein the effective cross-section area of the optical fiber at substantially 1550 nm wavelength is less than $75 \mu\text{m}^2$, and wherein the difference of losses between the 1550 nm wavelength and the 1625 nm wavelength is substantially 0.03 dB/km or less.

2. The optical fiber according to claim 1, wherein the wide-band dispersion controlled optical fiber includes an internal core which has a diameter d_1 and a refractive index n_1 ; an external core which encloses the internal core and has a diameter d_2 , the refractive index n_2 of the external core gradually decreasing from n_1 in the direction away from the center of the internal core; an internal clad which encloses the external core and has a diameter d_3 and a refractive index n_3 ; and an external clad which encloses the internal clad and has a refractive index n_4 ,

3. The optical fiber according to claim 2, wherein the diameters meet with the relationships of $0 \leq d_1/d_2 \leq 0.8$ and $0.1 \leq d_2/d_3 \leq 0.5$ and the refractive indexes meet with the relationships of $n_1 > n_2 \geq n_3 \geq n_4$, $0.0034 \leq (n_1 - n_4)/n_1 \leq 0.007$, $0 \leq (n_2 - n_4)/n_2 \leq$

0.0048, and $0 \leq (n_3 - n_4)/n_3 \leq 0.0014$.

4. The optical fiber according to claim 1, wherein the optical fiber has a dispersion slope of substantially $0.074 \text{ ps/nm}^2/\text{km}$ or less at the zero dispersion wavelength.

5

5. The optical fiber according to claim 1, wherein the optical fiber has a dispersion value of -9 ps/nm/km or more at substantially 1310 nm wavelength.

6. The optical fiber according to claim 1, wherein the optical fiber has a loss of 0.25 dB/km or less at substantially 1625 nm wavelength.

10

7. The optical fiber according to claim 1, wherein the optical fiber has a bending loss of 0.05 dB or less at substantially 1550 nm when it is wound 100 turns around a roller with a diameter of 60 mm .

15

8. A wide-band dispersion controlled optical fiber, wherein a cut-off wavelength is 1285 nm or less, dispersion values are -12 to -4 ps/nm/km in a wavelength region of 1285 nm to 1330 nm and 8 to 14 ps/nm/km at 1625 nm wavelength, and the dispersion slope is $0.074 \text{ ps/nm}^2/\text{km}$ or less at zero dispersion wavelength.

20

9. The optical fiber according to claim 8, wherein the zero dispersion wavelength of the optical fiber is positioned in a wavelength region of less than 1430 nm .

10. The optical fiber according to claim 8, wherein the effective cross-section area of the optical fiber is less than $75 \mu\text{m}^2$ at 1550 nm wavelength.

5 11. The optical fiber according to claim 8, wherein the dispersion values are -6 ps/nm/km or less at 1310 nm and 14 ps/nm/km or less at 1625 nm wavelength.

12. The optical fiber according to claim 8, wherein the optical fiber has a bending loss of 0.05 dB or less at 1550 nm when it is wound 100 turns around a roller with a
10 diameter of 60 mm.

13. The optical fiber according to claim 8, wherein the wide-band dispersion controlled optical fiber includes an internal core which has a diameter d_1 and a refractive index n_1 ; an external core which encloses the internal core and has a diameter d_2 , the
15 refractive index n_2 of the external core gradually decreasing from n_1 in the direction away from the center of the internal core; an internal clad which encloses the external core and has a diameter d_3 and a refractive index n_3 ; and an external clad which encloses the internal clad and has a refractive index n_4 ,

20 14. The optical fiber according to claim 13, wherein the diameters meet with the relationships of $0 \leq d_1/d_2 \leq 0.8$ and $0.1 \leq d_2/d_3 \leq 0.5$ and the refractive indexes meet with the relationships of $n_1 > n_2 \geq n_3 \geq n_4$, $0.0034 \leq (n_1 - n_4)/n_1 \leq 0.007$, $0 \leq (n_2 - n_4)/n_2 \leq$

0.0048, and $0 \leq (n_3 - n_4)/n_3 \leq 0.0014$.

15. A wide-band dispersion controlled optical fiber comprising:

- an internal core;
- 5 an external core enclosing the internal core;
- an internal clad enclosing the external core; and
- an external clad enclosing the internal clad, wherein respective refractive indexes between the cores and the clads are tuned using respective diameters and distribution of refractive indexes to obtain a predetermined cut-off wavelength and
- 10 predetermined negative range of dispersion values in an O-band wavelength region, a predetermined dispersion value in a positive range the C-band and L-band wavelength regions, a zero dispersion wavelength positioned in a wavelength region of less than a predetermined value, and wherein a cross-section area at a predetermined wavelength is
- less than a predetermined value, and wherein deviation of optical loss according to
- 15 wavelength is below a predetermined value.

16. The optical fiber according to claim 15, wherein the cut-off wavelength is 1285 nm or less and the dispersion values are -12 to -4 ps/nm/km in a wavelength region of 1250 nm to 1330 nm and 8 to 14 ps/nm/km at 1625 nm wavelength.

20

17. The optical fiber according to claim 15, wherein the zero dispersion wavelength is positioned in a wavelength region below 1430 nm.

18. The optical fiber according to claim 15, wherein the effective cross-section area at 1550 nm wavelength is less than $75 \mu\text{m}^2$,
19. The optical fiber according to claim 15, wherein the deviation of optical loss
- 5 according to wavelength is below a predetermined value is 0.03 dB/km or less.